CLAIMS

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is as follows:

1. A method comprising diagnosing from a repository at least one fault in a system, said repository represented as a directed graph having one or more undivided directed subgraphs, the step of diagnosing comprising the steps of:

receiving a first description of said at least one fault;

employing said first description to identify a response from the said repository;

if the response is a diagnosis stopping, otherwise identifying at least one subgraph responsive to said first description;

using said at least one subgraph in determining said diagnosis, stopping if said diagnosis results, otherwise forming a modified description based upon said at least one subgraph; and

replacing said first description with said modified description and repeating the steps of receiving, employing, identifying and using until said diagnosis results.

2. A method as recited in claim 1, wherein the first description is completely covered by the diagnosis, the method further comprising implementing a solution based on the diagnosis.

3. A method as recited in claim 1, wherein the first description includes a set of symptoms describing said at least one fault.

4. A method as recited in claim 3, wherein the modified description includes an additional set of symptoms identified for probing by the subgraph.

5. A method as recited in claim 1, wherein the first subgraph is identified by a method

employing an index mapping descriptions to initial subgraphs, the trivial index simply mapping all descriptions to one subgraph.

6. A method as recited in claim 1, wherein said repository is remote and said undivided subgraphs are downloaded from said repository to a local agent performing the diagnosis as needed.

7. A method as recited in claim 1, wherein said system is a system taken from a group of systems consisting of: a machine; a software program; a process; and any combination of these.

8. A method as recited in claim 1, having a limitation taken from a group of limitations consisting of:

wherein each said undivided subgraph is implemented as executable code;

wherein said executable code is written in an object-oriented programming language;

wherein said executable code is written in a programming language that supports late binding;

wherein said programming language supports late binding and on-demand downloading of classes;

wherein said programming language that is object-oriented and supports late binding and on-demand downloading of classes is Java;

wherein said local agent is a machine;

wherein said remote repository is downloaded as needed onto a small computing device;

wherein said remote repository is hosted by a service provider supporting a plurality of customers and having each customer download subgraphs as needed to perform diagnosis;

wherein at least one of said customers is a customer support center diagnosing faulty systems on behalf of a plurality of its own customers;

wherein said customer is a field representative performing diagnosis of a failing system;

wherein said customer is a faulty system operating in a self-diagnostic mode; and

wherein said faulty system applies the solution identified by the fault diagnosis system in an autonomic, self-healing mode; and

any combination of these limitations.

9. A method as recited in claim 1, wherein said diagnosing is done proactively to prevent faults from occurring in the future and/or to train someone to use said system successfully so that faults will not occur.

10. A method as recited in claim 1, wherein said repository enables an on-demand fault diagnosis system with a service provider charging each customer for an amount of resources consumed during any diagnosis session.

11. An article of manufacture comprising a computer usable medium having computer readable program code means embodied therein for causing diagnosis from a repository of at least one fault in a system, the computer readable program code means in said article of manufacture comprising computer readable program code means for causing a computer to effect the steps of claim 1.

12. A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for diagnosing from a repository at least one fault in a system, said method steps comprising the steps of claim 1.

13. An apparatus comprising means for diagnosing from a repository at least one fault in a system, said repository represented as a directed graph having of one or more undivided directed subgraphs, the means for diagnosing comprising:

means for receiving a first description of said at least one fault;

means for employing said first description to identify a response from the said repository;

means for if the response is a diagnosis stopping, otherwise identifying at least one subgraph responsive to said first description;

means for using said at least one subgraph in determining said diagnosis, stopping if said diagnosis results, otherwise forming a modified description based upon said at least one subgraph; and

means for replacing said first description with said modified description and repeating the steps of receiving, employing, identifying and using until said diagnosis results.

14. A computer program product comprising a computer usable medium having computer readable program code means embodied therein for causing diagnosis from a repository of at least one fault in a system, the computer readable program code means in said computer program product comprising computer readable program code means for causing a computer to effect the functions of claim 13.

15. A method for diagnosing a fault, said method comprising:

commencing a diagnosis session;

initializing a current state, the current state being symptoms comprising an initial description of a fault being diagnosed;

identifying one graph from a repository of graphs which, when taken together, encode symptoms and diagnoses of a system, and assigning said one graph to be the current graph;

retrieving said current graph from the repository;

assigning one node of the current graph to be the current node;

identifying the node type of the current node; and

if the current node is of type diagnosis, then returning the diagnosis associated with the node as the diagnosis of the fault;

if the node type is not of type diagnosis then performing a particular node type operation, and repeating the step of identifying the node type of the current node, until the node type of the current node is of type diagnosis.

16. A method as recited in claim 15, wherein the step of identifying one root graph comprises employing indexing graphs by symptoms.

17. A method as recited in claim 15, wherein:

the repository of directed graphs is a remote repository, remote from a process running the fault diagnosis session, said remote repository comprising a complete set of directed graphs which taken together encode the symptoms and diagnoses of the fault diagnosis system;

the step of identifying one graph incorporates logic to remotely ask the repository to identify one graph at a known or discoverable location; and

the step of retrieving incorporates logic to retrieve remotely from said known or discoverable location.

18. An article of manufacture comprising a computer usable medium having computer readable program code means embodied therein for causing diagnosis of a fault the computer readable program code means in said article of manufacture comprising computer readable program code means for causing a computer to effect the steps of claim 15.

19. A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for diagnosing a fault, said method steps comprising the steps of claim 15.

20. A method as recited in claim 15, wherein said repository enables an on-demand fault diagnosis system with a service provider charging each customer for an amount of resources consumed during any diagnosis session.

21. A method as recited in claim 15, wherein:

if the current node is of type call-graph, then the step of performing a particular node type operation includes setting the current graph to be a graph associated with the call-graph node, and repeating the steps of retrieving and assigning;

if the current node is of type functional-branch, then the step of performing a particular node type operation includes evaluating a function associated with the functional-branch node over the current state of the diagnosis session, and assigning the value of the

function to be the current node;

if the current node is of type question, then the step of performing a particular node type operation includes asking a question associated with the current node, collecting an answer to the question, updating the current state with a pair having a form <question, answer>, traversing an edge labeled by the answer or by a function that accepts the value as being valid, reaching a new node in the current graph, and assigning the new node to be the current node;

if the current node type is of type test, then the step of performing a particular node type operation includes performing a test on the faulty system, adding additional symptoms to the current state based on the test results, traversing the edge leaving the current node to reach a new node and assigning the new node to be the current node;

if the current node type is of type lookup, then the step of performing a particular node type operation includes querying a source external to the diagnosis system and the user, adding additional symptoms to the current state based on the query results, traversing the edge leaving the current node to reach a new node and assigning the new node to be the current node; and

if the current node type is of type state-transformation, then the step of performing a particular node type operation includes applying a function associated with the state-transformation node to the current state to modify the current state, traversing the edge leaving the current node to reach a new node and assigning the new node to be the current node.

22. A method as recited in claim 15, wherein:

a node of type diagnosis is a node representing one definitive diagnosis of the fault and optionally supplying an action plan to remedy the fault;

a node of type call-graph is a node connecting one graph to another graph, allowing composition of graphs;

a node of type functional-branch is a node which allows a transfer of control to any other node in the current graph where the new node is the computed value of a function (associated with the functional-branch node) of the current state of the diagnosis session, where the current state is represented by the set of all <question, answer> pairs formed from questions already answered in the current session; and

a node of state-transformation is a node which allows modification of the current state by applying a function associated with the state-transformation node to the current state to modify it.